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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/615,630	07/09/2003	Jiang Yan	2003 P 51686 US	1460
25962	7590	06/18/2004	EXAMINER	
SLATER & MATSIL, L.L.P. 17950 PRESTON RD, SUITE 1000 DALLAS, TX 75252-5793			LEE, CALVIN	
			ART UNIT	PAPER NUMBER
			2825	

DATE MAILED: 06/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/615,630

Applicant(s)

Jiang YAN et al.

Examiner

Lee, Calvin

Art Unit

2825

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Amendment & Remark dated 5/27/04.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 May 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

OFFICE ACTION***Response to Amendment***

1. The amendment of claim 21, received on May 27, 2004, is acknowledged

Claim Rejections - 35 U.S.C. § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-3, 5-7, 9-11, 13-15, 17-18, 20, 22, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Applicant's Prior Art (APA)* in view of *Pinto et al (US 6,667,226)*.

- a) *APA* discloses a method of forming isolating regions, comprising the steps of:

- providing a workpiece **100** having at least one first region **107** and one second region **110**, wherein the first region comprising one high voltage active area **108** and the second region comprising one low voltage active area **112** [Fig. 1]
- patterning the first region with one deep trench **114** having sidewalls, a bottom, and a first depth within the workpiece
- forming a first insulating layer **116** over the deep trench sidewalls and bottom [pages 2-3]
- depositing a material **118** in the deep trench over the first insulating layer
- inherently masking the first and second regions using a photoresist as a mask
- patterning the first and second regions with a shallow trench having a second depth less than the first depth, thereby resulting the semiconductive material being recessed beneath the workpiece's top surface by a gap (i.e., the thickness of the subsequent shallow trench isolation)
- inherently removing the mask over both first and second regions
- depositing an insulating material in the shallow trench to form a shallow trench isolation region **124**, and on the semiconductive material recess to form another shallow trench isolation region **124a** aligned on the deep trench
- forming the low voltage active area **112** in the second region

- b) In re claims 6 and 14, *APA* is silent about a thin silicon nitride layer over a thin silicon dioxide layer that is "over the at least one second trench and over the semiconductive material recess of the at least one first trench." *Pinto et al*, teaching isolation formation that is compatible

with *APA*, discloses that forming a silicon nitride **434a** over a silicon dioxide layer **454** [Fig. 4F], and over a second trench **430** and a semiconductive material recess [Fig. 4D] of a first trench **408a** [col. 8]. It would have been obvious to one of ordinary skill to have modified the process of *APA* by utilizing a multi-layer insulation for the shallow isolation structure for the purpose of maximizing the shallow isolation.

c) In re claims 7 and 15, *APA* fails to disclose such process steps as: depositing the semiconductive material in the deep trench over the first insulating layer, and recessing the semiconductive material below the workpiece top surface. *Pinto et al*, teaching the isolation-region formation whose deep trench **208a** is filled with a poly-Si material **228a**, which is subsequently recessed below the trench opening at the upper level of the substrate [Fig.2C and cols. 4-5].

It would have been obvious to one of ordinary skill to have modified the process of *APA* by utilizing a self-alignment process for the purpose of ensure that the critical overlap tolerance between the active area level and deep trench level is increased and there is a good conduction path from the active area through the strap and into the deep trench storage capacitor [col. 7].

d) In re claims 9, 17 and 24, *APA* discloses the semiconductor material recess having a depth below the top surface of the workpiece that is equal to the shallow trench second depth [Fig. 1].

4. Claims 4, 12, 19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over *APA* in view of *Pinto et al*, and further in view of *Mandelman et al* (US 6,284,593).

a) *Pinto et al* suggests a liner comprised of silicon nitride film **120** over silicon dioxide film **118** [col. 3]. *Mandelman et al* discloses that a deep trench **15** is alternately covered by a thin oxide layer **35** over a thin nitride layer **30** [Fig. 6A and col. 6].

It would have been obvious to one of ordinary skill to have modified the liner of *Pinto et al* by utilizing an oxide on top of a nitride instead for the purpose of protecting the underlying sidewall and bottom of the deep trench, which is embedded inside an insulating layer and/or substrate.

b) In re claims 19 and 21, *Mandelman et al* also suggests the hard mask formed by depositing BSG. Furthermore, *Mandelman et al* suggests depositing HDP (high density plasma) oxide [col. 6].

It would have been obvious to one of ordinary skill to have modified the hardmask of *APA* and/or *Divakarumi et al* by utilizing a BSG hardmask because the workpiece material usually has higher etch rate than those of BSG, TEOS, and HDP dioxide.

5. Claims 8, 16, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over *APA* in view of *Pinto et al*, and further in view of *Divakaruni et al* (US 6,184,107).

APA and/or *Pinto et al* suggests both deep and shallow trenches have the same width. *Divakaruni et al*, teaching isolation-region formation that is compatible with *APA*, discloses that shallow trenches 64 have a wider width than that of deep trenches 38 [Fig. 14].

It would have been an obvious matter of design choice to have the claimed trenches' width (suggested also by *Divakaruni et al*), since such a modification would have involved a mere change in the size of an isolation structure. A change in size is generally recognized as being within the level of ordinary skill in the art. *In re Rose*, 105 USPQ 237 (CCPA 1955).

Response to Arguments

6. Forbid to use Fig. 5, which looks similar to Fig. 1, the examiner sees that Fig. 1 and its description at least teach claims 1-3, 5, 9-11, 13, 17-18, 20, 22, and 24. The other pending claims are obviously rejected by the applicant's prior art and/or the cited arts.

Claims 22-24 are inclusive this time in the rejections under the applicant's prior art.

The typo error related to claim 8 has been fixed in response to the applicant's remark.

Contact Information

7. Any inquiry concerning this communication from the Examiner should be directed to *Calvin Lee* at (571) 272-1896 from 7:00 to 17:00 (Monday-Thursday). If attempts to reach the examiner by telephone are unsuccessful, Art Unit 2825's Supervisory Patent Examiner *Matthew Smith* can be reached at (571) 272-1907 weekdays (7:00 to 18:00).

Any inquiry relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-0596. The central fax number is (703) 872-9306 for all communications to be entered (e.g., amendments, remarks, IDS, etc.)

el

C. Everhart
CARIDAD EVERHART
PRIMARY EXAMINER

June 14, 2004